FY 2006

DEPARTMENTAL ANNUAL REPORT OF CONTINUOUS IMPROVEMENT

Department of Physics

College of Arts and Sciences

Fort Hays State University

600 Park Street

Hays, KS 67601

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I. Departmental Overview

The faculty and staff of the Physics Department are committed to the assessment process as a means of continuously improving the learning environment provided to participating students. The goal for the FHSU physics major is to prepare students for technical post-baccalaureate employment in business, industry, and government or for entrance into graduate study in physics, engineering or other related areas. The Educational Testing Service (ETS) Major Field Test in Physics has been used since 1995 to access the students' grasp of the fundamental principles of physics and their ability to apply them in the solution of problems. This is a nationally normed exam providing individually reliable total scores for each student and group-reliable scores known as assessment indicators. Physics graduates are also expected to develop communication and presentation skills, critical thinking skills, computing skills, library\information literacy skills and life-long learning skills. Graduates have the ability to work individually and also cooperatively as a member of a team. Any educated person set to enter the workforce in today's knowledge society must possess these skills. Alumni questionnaires and individual discussions with alumni and employers will be used to assess whether physics graduates possess these non-physics specific workplace skills. This provides short-term and long-term feedback loops through which the effectiveness of the departments' physics major program can be monitored and continuously improved.

A. Mission and Vision Statements

- Mission Statement
  We produce graduates with the knowledge, skills and attributes that will enable them to enter and be successful in graduate school or the workforce.

- Vision Statement
  We are the best undergraduate physics department in Kansas.

The Department of Physics at Fort Hays State University will offer quality physics courses for science, pre-professional, and non-science majors in order to prepare each student for advancement in his or her chosen field of study. Student learning will occur through classroom instruction, laboratory exploration, independent study, research experience, and distance learning courses. The department will serve as a regional resource on physics-related matters through consultation and outreach with a major emphasis on serving pre-college teachers of physics. The scholarly activities of the Physics Department will emphasize the preparation of upper-division undergraduate majors in research methods by providing the opportunity for them to collaborate with a faculty member on a research project. The strength of the Fort Hays State University physics programs is its flexibility, which allows students to build on their individual interests throughout the program.

The Physics Department mission statement is compatible with college of arts and sciences and the university mission statements. The FHSU mission statement maintains in part that "the university's primary mission is undergraduate liberal education, which includes the humanities, the fine arts, the social/behavioral sciences, and the natural/physical sciences.

These disciplines serve as the foundation of all programs." The Department of Physics supports this mission through its general education offerings, cognate courses required for other disciplines, courses for students in pre-professional areas of study, and the preparation of graduates for entry into graduate school, employment by government or industry and entry into K-12 science teaching.

B. Goals, Objectives, and Strategic Priorities

To fulfill the department's mission, courses are designed to accomplish the following goals:

- Provide students with a knowledge of physics: the fundamental laws of nature which form the foundation upon which astronomy, biology and allied health, chemistry and geosciences are based.

- Provide students with the skills needed in a technological society: oral, written and electronic communication skills, critical thinking skills, analytical thinking skills, problem solving skills, logical thinking, ability to define a problem, computer skills, ability to design an experiment, and the ability to draw conclusions from an experiment.

- Provide students with research experiences: develop the traits and work ethic important in a technological environment including being creative, persistent, self confident, being able to work individually, and most importantly, being able to works as a part of a team.

The curriculum which is used to fulfill these goals can be found on the affinity diagram under section VI. Supporting Materials, A. Degree Program Affinity Diagrams.

The strategic priorities of the physics department are:

- A faculty for whom undergraduate teaching and student success are top priorities.

- Graduates who are in demand by industry, government, K-12 schools, and post-graduate educational institutions.

- Student involvement in undergraduate research participation projects.

- Thoughtful adoption of changes in courses and the curriculum in response to needs of industry, government and graduate schools.

II. Departmental Highlights

A. Productivity and Other Distinctive Accomplishments
The Department of Physics continues to be productive in the areas of

- A tenure-track search was successfully completed when Dr. Catherine F. M. Clewett, a chemical physicist, with expertise in hydrogen storage of carbon nanotubes using nuclear magnetic romance (NMR) and electron spin resonance (ESR) signed a contract to teach and supervise undergraduate student research for FY 2007.

- Fifteen students were enrolled in undergraduate research participation projects during AY2006.

- Undergraduate research participation students presented ten poster presentations at the 2006 FHSU Science Research showcase.

- Student Summer 2006 Research Internships were awarded to seven Physics majors

  Joan Dreiling: Working in Carl Wieman's (Physics Nobel Laureate, 2001) Bose-Einstein Condensation Group at the University of Colorado-Boulder.

  Matt Wood: Working on assembling and testing detectors for the CMS (Compact Muon Solenoid) at the CERN particle accelerator in Geneva, Switzerland.

  Seth Topefer: Working in Dr. Ryan Doezema's condensed matter physics group at the University of Oklahoma in Norman, OK.

  Lance Irvin: Working on a theoretical model for laser beam propagation in biological systems by Air Force Research Laboratories at Brooks-City Base, San Antonio, TX.

  Paul Maseberg: Working on a robust three dimensional thermal model to simulate the effects of laser energy on biological tissue at FHSU with Dr. Gavin Buffington (for Air Force Research Laboratories at Brooks-City Base, San Antonio, TX).

  Nate Burnett: Working on the development of Mix Design of Asphalt Pavements for Turks and Caicos Islands in the Transportation Engineering Department at the Worcester Polytechnic Institute, in Worcester, MA.

  Roger Bach: Working at the Atomic and Molecular Laboratories, University of Nebraska-Lincoln.

- Faculty Summer 2006 Research Internships

  Kayvan Aflatooni: Working at the Atomic and Molecular Laboratories, University of Nebraksa-Lincoln in collaboration with Dr. Herman Batelean. Together they will be assembling a novel apparatus to be the first to observe free electron interference.

  Ken Trantham: Collaborating with the Thomas Jefferson National Accelerator Facility in Newport News, VA, on the construction of a Mott type electron polarimeter for use with J-Lab's polarized electron accelerator. Dr. Trantham will also be working at the Atomic and Molecular Laboratories, University of Nebraska-Lincoln with Professor T. J. Gay, where he will further develop an apparatus to study collisions between spin polarized electrons and chiral molecules.

- Fourteen two-person teams representing three middle schools competed on March 13, 2006, in a robotic contest initiated by Dr. Ken Trantham. Teams competed in three double-elimination events: (a) brick maze, (b) line following, and (c) sumobot. Medals were awarded to the top three teams in each event. A final demolition derby was held and a trophy was awarded to the overall winner based on results of all four events.

- Mobile Computing

  During the 2005-2006 academic year, the Department of Physics was fortunate to be chosen as a pilot department in the mobile computing initiative. During this pilot period the faculty of the physics department have been actively engaged in aspects of this project ranging from network infrastructure to brainstorming on what types of software / hardware would enable the mobile computing model to be effective pedagogically.

  The department appreciates the magnitude of the initiative and the difficulty of wireless network deployment coupled with the scarcity of software which will efficiently and effectively enable learning in the mobile computing model. One of the first obstacles that we encountered was poor wireless network coverage and sluggish network authentication. Drs. Buffington and Trantham experienced limited usefulness of the mobile computing environment during most of the Fall 2005 semester due to this difficulty. Lack of network connectivity caused significant delays and were disruptive while attempting to use the faculty tablet computers in the classroom. Students and faculty in the physics department working closely with CTC staff have helped to identify and solve some of the problems with network connectivity. While the wireless network coverage in Tomanek Hall has significantly improved, there are still challenges regarding poor connectivity and long authentication times. We are somewhat anxious about this issue as we forge ahead into the next year of this project.

The physics faculty have employed the mobile computing technology with some success by employing several strategies. All of these strategies are aimed at increasing student engagement in the learning process. Some simple and obvious classroom activities involve replacing traditional chalkboard lectures with 'electronic' lectures utilizing the ability of the tablets and pens. This seems simple but when one considers the nature of a physics lecture, dense with mathematical formalism, figures, diagrams, and graphics, the ability to *electronically* write on the tablet screen is extremely powerful. Additionally, we have shifted away from lecture mode to more of a collaborative learning model where students contribute to the lecture notes by using tablets as well. This is an exciting approach that seemed to be well received if not a refreshing change for the physics students. The full potential of this approach will not be uncovered until a solid wireless network and appropriate software applications are available. While there was significant success, there was also considerable frustration with network issues and lack of software applications to fully enable this process. More advanced uses of mobile computing in the physics department include having a set of computers with a common suite of software that allows both students and faculty to undertake learning challenges involving the development of software to solve problems in mathematical / computational physics, using tablet computers in the experimental laboratory to control equipment, collect and analyze data. Student enthusiasm toward this project remains very high despite the challenges identified earlier. Both physics students and faculty find that the tablet PC is significantly more useful and powerful than a laptop which does not have the 'pen' capability.

Dr. Hrepic has taken the initiative to explore the DyKnow application and arranged for demonstration of this technology at FHSU. During the Summer 2006 semester, the DyKnow system was deployed in a section of Physical Science course (general education). Student feedback indicates a positive response to the use of the DyKnow system in the mobile computing environment. Dr. Hrepic reports that this application is an effective tool to facilitate:

- Delivery of content
- Student note taking
- Classroom interaction at a variety of levels (collaborative group assignments, problem solving, data collection and analysis)
- Peer instruction and student discussions
- Management of assignments / grades
- Formative assessment

Performance Indicators

Key Performance Indicator	Baseline FY2004	Actual FY2005	Actual FY2006	Goal FY2007
Number of New Freshmen	20	23	13	20
Number of Transfer Students	7	3	1	3
Number of Majors				
Undergraduate (first majors/second majors)	60/4	63/4	42/2	50/3
Graduate				
Departmental majors	0	0	0	0
MLS students	0	0	0	0
Student Credit Hour Production				
Undergraduate	3401	3512	3750	3800
Graduate	46	123	127	120
FTE Faculty (Headcount)				
Tenured or Tenure Track Faculty (Headcount)	5 (5)	5 (5)	5 (5)	5 (5)
Non Tenure Track Faculty (Headcount)	0.5 (1)	0.5 (1)	0.5 (1)	0.5 (1)
Other Faculty (Headcount/Sections Taught)	0	0	0	0
Degrees Awarded				
Undergraduate:	6	9	2	6
Graduate:				
Departmental degrees		N/A	N/A	N/A
MLS degrees	1	0	0	0

Scholarly Activity (See Section IV for documentation requirement)				
Number of books, book chapters, and **refereed** articles published & invited presentations	4	4	4	4
Percent of faculty publishing **refereed** books, chapters, or articles and presentations	50%	60%	60%	60%
Number of **non-refereed** articles and presentations	5	7	6	7
Percent of faculty publishing **non-refereed** articles or presentations	40%	60%	80%	60%
Total number of external grant applications submitted / percent of faculty submitting		2/20%	2/40%	2/40%
Total number of funded external grants / percent of faculty funded		1/20%	1/20%	1/20%
Service Activity				
Percent of faculty meeting acceptable standard of service activity	100%	100%	100%	100%
Percent of faculty meeting exceptional standard of service activity	0	0	0	0
Assurance of Student Learning				
ETS Major Field Test in Physics				
% exceeding National Mean Score				
Total Score	67%	60%	50%	100%
Lower Division	67%	60%	N/A	100%
Upper Division	67%	60%	N/A	100%
(See Part IV, E)				

Senior Seminar: % passing with grade of A or B	100%	83%	100%	100%
Other Departmental Key Performance Indicators (up to 3 additional measures, optional) Post-Graduate Study or Degree Related Employment % Post-Graduate Study % Degree Related Employment % Unknown	 0 50 50	 44 22 33	 0 50 50	 40 60 0

B. Current Quality Initiatives and Results

Continuous learning is essential for positive growth and improvement within the department. Current quality initiatives within the Department of Physics are directed towards - - - - -

FY 2006 Quality Initiatives	**Results**
Mobile Computing	Drs. Buffington, Hrepic, and Trantham have fully embraced the mobile computing technology and have deployed it in some manner in **all** of their courses during this pilot period. Significant progress has been made by using mobile computing technology in these courses. The following list gives an overview of how this technology has been used: • Use of Blackboard to distribute course information, collect student contributions, and maintain grades • Use of Micro$oft OneNote to deliver electronic lecture notes and enable real time collaboration between students

	and faculty • Use of National Instruments LabView to automate equipment, data collection, and data analysis in the laboratory • Use of Micro$oft Visual Studio to develop software to solve problems in mathematical / computational physics (both with regard to courses as well as research) • Use of networked tablets to bring 'live' content to the learning process • Exploration of the DyKnow application to facilitate and manage the flow of information in the classroom
Student Response System	My experience (Dr. Hrepic) with the classroom response system ("clickers") extends over the period of several semesters, primarily in the physical science course. Clickers are a very useful tool in promoting classroom interaction. All topics do not lend themselves equally well to polling, so the system might not contribute equally to all parts of a course. However, because of the benefits in promoting peer instruction and formative assessment, it is well worth implementing in the classroom when possible. It should be added however, that with mobile computing with classroom interaction software that incorporates polling, classroom response systems as stand alone devices are likely to become outdated in near future.

FY 2007 Quality Initiatives	Responsible Party, Resources, and Plan
Develop a student alumni tracking system.	The physics faculty will work as a team to develop an effective method for tracking physics alumni, pre-engineering transfer students, and dual degree transfer students after they leave FHSU.
Enhanced Student Research Opportunities	Design and construct a suitable research facility for Dr. Catherine Clewett's (new faculty member). The physics faculty will collaborate to identify a suitable physical space, funding opportunities, and interested students to support Dr. Clewett's research adgenda.

III. Strategic Plan and Opportunities for Improvement for FY2007

A. Reflection of Strengths, Weaknesses, Opportunities, and Threats

Departmental assessment is an ongoing process. - - - - -

Strengths	Weaknesses/Needs
• High quality faculty dedicated to undergraduate education. • Outstanding and effective departmental administrative assistant. • Strong support from upper level administration. • Support obtained through the strategic planning process. • Faculty willingness to mentor students in real-world undergraduate research projects. • Cooperative research program with the Air Force Research Laboratory and Northrop Grumman Information Technologies. • FHSU faculty involvement with University of Nebraska at Lincoln physics research projects.	• The continued difficulty in recruiting under-represented students. • The nationwide reluctance of students to enroll in STEM degree programs and in math and science teaching programs.

• Affiliate membership in the Kansas Space Grant Consortium.	
Opportunities	**Threats**
• Involvement in the Kansas biotechnology initiative.	• Funding of K-12 education may result in decreased funding in higher education. • Faculty burn-out. • The gap between industrial and FHSU salaries increases to the point that teaching is no longer considered as a viable option.

B. Opportunities for Improvement

Short Term OFI	Resources Required	Expected Outcome and Completion Date
See FY 2007 Quality Initiatives		

[NOTE: Long-term OFIs are meant to be resource intensive changes requiring permanent or one time resources that can favorably impact the department over the long-term]

Long Term Strategic Initiatives	Resources Required	Expected Outcome
Develop a biophysics degree. There are presently no undergraduate biophysics degree programs in Kansas. Two new physics courses would have to be developed and possibly some new biology courses.	1 new faculty position	Increased involvement with the bioscience initiative and additional enrollment in physics.

Add a lab/demonstration equipment maintenance and developer position to the department. An M.S. in physics would be required and it could be a classified position or a non-tenure track unclassified position.	Unknown.	There would be an increased use of lecture demonstrations and the quality of student laboratory experiences will be enhanced. The department's virtual college courses would serve additional off-campus students.

IV. Supporting Materials

A. Degree Program Affinity Diagram(s)

B. Staffing Plan

C. Bibliography of Scholarly Activity

D. Program Assessment Results

E. Other Departmental Information

F. Special AQIP Report

A. Degree Program Affinity Diagram(s)

College of Arts and Sciences
Affinity Diagram for Degree Programs

What are the **elements/building blocks** of a degree program in Physics that will meet the educational needs of the prospective Physics major?

Characteristics of Physicists	Expected Learning Outcomes	Curriculum	Assessment Approach and Methods
Employment They have a scientific and mathematical background to be employed in diverse areas of business, government and industry. **Graduate School** They are capable of being successful in graduate programs in many areas besides just physics. **Lifelong Learning** They have developed independent learning skills for a lifetime of continued learning.	**Analytical** They think and act scientifically. **Creative/Objective** They generate fresh ideas, develop new knowledge, and become open-minded. **Persistent/Cooperative** They are motivated by curiosity for finding the laws of nature with determination, teamwork, and continuous effort. They recognize the value of other fields. **Intellectual** They are equipped with sequential knowledge and skills for practical applications, problem solving, and correct decision making. **Leaders for Human Advancement** They lead in the fields of science and engineering, guide high-tech development for improving the quality of life, and serve as the driving force for the advancement of society. **Communicative** They possess both oral and written communication skills.	**Program Core Curriculum** **Develop Knowledge & Problem Solving Skills** PHYS 211/211L Physics for Scientists and Engineers I/Lab PHYS 212/212L - Physics for Scientists and Engineers II/Lab PHYS 451 - Atomic Physics PHYS 521 - Mechanics PHYS 532 - Electricity & Magnetism PHYS 651 - Advanced Lab I PHYS 654 - Advanced Lab II CHEM 120/120L - University Chemistry I/Lab CHEM 122/122L - University Chemistry II/Lab MACS 234 - Analytic Geometry and Calculus I MACS 235 - Analytic Geometry and Calculus II MACS 236 - Analytic Geometry & Calculus III **B.A. Curriculum** **Develop knowledge and problem-solving techniques** PHYS 432 - Analog and Digital Electronics **Develop Perspective** Physics Electives **B.S. Curriculum** **Develops knowledge and problem solving techniques** PHYS 520 -Mathematics for the Physical Sciences MACS 354 - Differential Equations **Develops Perspective** Physics Electives	ACT Scores are collected for each incoming freshman. Course Written Exams to provide students with performance feedback and assess the learning in each subject. Laboratory performance is used to evaluate students' experimental skills and capabilities in the applications of theories. Laboratory notebooks and formal reports are used to assess student performance and provide feedback. Major Field Tests in Physics are administered to assess the performance of junior and senior physics majors. Senior Seminars are conducted to evaluate majors' training in pre-professional activities and their scientific communication skills. Alumni surveys are used to assess the perceived effectiveness of the program.

Affinity Diagram for Degree Programs

What are the **elements/building blocks** of a degree program in physical science/physics teaching that will meet the educational needs of the prospective teacher in the physical sciences/physics major?

Characteristics of Physicists	Expected Learning Outcomes	Curriculum	Assessment Approach and Methods
Knowledge Teachers of science use their mastery of content knowledge to plan an inquiry-based science program for students. **Skilled** Teachers of science guide and facilitate learning. **Reflective** Teachers of science engage in ongoing assessment of their teaching and of student learning. **Creative** Teachers of science design their teaching to effectively use the time, space, and resources allocated. **Intellectual Leaders** Teachers of science develop communities of science learners that reflect the intellectual rigor of scientific inquiry and the attitudes and social values conducive to science learning. **Community Leaders** Teachers of science actively participate in the ongoing planning and development of the science programs.	**Goal A** To learn essential science content through the perspectives and methods of inquiry. ***Objective #1*** To be able to lead safe laboratory investigations in the physical sciences. ***Objective #2*** To be able to apply physical concepts and mathematical skills in solving problems. ***Objective #3*** To be able to design, conduct, and draw conclusions from experiments. **Goal B** To integrate knowledge of science, learning, pedagogy, and students. ***Objective #1*** To be able to apply that knowledge to science teaching. ***Objective #2*** To be able to design instruction to address students' folk concepts. ***Objective #3*** To be able to design instruction appropriate for learners' abilities and learning styles. ***Objective #4*** To be able to communicate effectively with both the education and scientific communities. **Goal C** To build understanding and ability for lifelong learning ***Objective #1*** To be able to identify strengths and weaknesses as a teacher from which to articulate a professional development plan. ***Objective #2*** To be able to discuss improvement in teaching and assessing through use of technology and professional resources. **Goal D** To develop an integrated and coherent picture of science and mathematics. ***Objective #1*** To be able to integrate physical science phenomena in a comprehensive, systematic and interrelated body of knowledge. ***Objective #2*** To be able to plan meaningful integrated learning experiences. ***Objective #3*** To be able to teach effectively in more than a single discipline.	**Teacher Education Curriculum** *Knowledge of Learning, Pedagogy and Students* ACES 202 Foundations of Education TEEL 231 Human Growth and Dev. PHYS 277 E. Fld. Exp. *or* CHEM 277 E. Fld. Exp. *or* GSCI 277 E. Fld. Exp. TESE 601 Educating Exceptional Students TEEL 431 Educational Psychology TEEL 485 Reading & Comprehension of Text ACES 495 The Secondary School ACES 496 Directed Teaching **BS in Physical Science Core** *Essential Science Content* PHYS 111/111L Physics I/Lab *or* PHYS 211/211L Physics for Scientists & Engineers I/Lab GSCI 200/200L Physical Geology/Lab MACS 261 Computer Science I PHYS 309 Descriptive Astronomy PHYS 506 P. Sci. Teaching Practicum CHEM 476 Apprenticeship in Chemistry *or* GSCI 476 Apprenticeship in Geology **BS Electives (choose two of three areas)** *Integration of Science* **Chemistry Emphasis:** CHEM 122/122L University Chemistry I/Lab CHEM 250/250L Chemical Analysis/Lab CHEM 304/304L Essentials of Organic Chemistry **Earth & Space Sciences Emphasis:** GSCI 202/202L Historical Geology/Lab GSCI 355 Field Trips in Geology Approved electives **Physics Emphasis:** PHYS 112/112L Physics II/Lab *or* PHYS 212/212L Physics for Scientists & Engineers II/Lab PHYS 353 Concepts of Modern Physics *or* PHYS 451 Atomic Physics Physics electives	**Initial Profile** ACT Scores are collected for each incoming freshman. **Knowledge of Teaching** PPST and the NTE will be used to measure teachers' knowledge related to the profession of teaching. These will be compared to national norms. **Content Knowledge** The comprehensive final exam scores from selected courses will be compiled to ascertain the effectiveness of the program in terms of student performance. **Integrated Knowledge of Science and Teaching** Field experiences are used to evaluate students' abilities for teaching and assessing science and integrating science, learning, and pedagogy and knowledge of students. **Capstone experience** Directed teaching is used to assess the overall outcomes of the program. **Lifelong Learning** Alumni surveys are used to assess the perceived effectiveness of the program.

B. Staffing Plan

College of Arts and Sciences
Department Staffing Plan and Assignments (Current)
Department of Physics
Date: June 2006

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Current Department Needs	Faculty Member	Current Faculty Expertise	Retirement (Birthdate)	Assigned Instructional FTE's	Rank Current Date	Degree Completed	Track	Current Salary In Line	2002 Nat'l Average For Discipline/ Rank**	% Above(Below) 2002 Nat'l Average	Peer Average For Discipline/ Rank	% Above(Below) Peer Average
1.0	Aflatooni, K.	Exp. Atomic / Optics	3/2/1959	1.0*	Assistant Professor 2000	Ph.D. 1999	Tenured	41,541	46,500	(11.9%)	Unknown	Unknown
1.0	Buffington, G.	Atomic Theory / Laser Biophysics / Computational Physics	6/9/1967	1.0*	Associate Professor 2002	Ph.D. 1997	Tenured	53,872	55,000	(2.1%)	Unknown	Unknown
1.0	Caplan, L.	Exp. SolidState/Adm	11/18/1937	1.0	Professor 1980	Ph.D. 1975	Tenured	82,557	89,833	(8.8%)	Unknown	Unknown
1.0	Hrepic, Z	Physics Education	6/20/1972	1.0	Assistant Professor 2004	Ph.D. 2004	Tenure Track	41,000	46,500	(13.4%)	Unknown	Unknown
1.0	Trantham, K	Exp. Atomic / Exp. Laser Biophysics	9/30/1965	1.0*	Assistant Professor 2003	Ph.D. 1996	Tenured	44,506	46,500	(4.5%)	Unknown	Unknown
0.5	Scott, W	Physical Science / General Education	3/11/1945	0.5	Instructor 1999	M.S. 1970	Temporary	15,068	Unknown		Unknown	Unknown
			Total	**5.5**								

* Assigned Instructional FTE does not include projects courses which are currently being taught on an overload basis.
** From Faculty Salaries, 2002 (American Institute of Physics, Statistical Research Center)

Diversity Ratio = _0__ Tenure Density = _0.727__

AMERICAN INSTITUTE OF PHYSICS
One Physics Ellipse
College Park, IVID 20740-3843

AIP REPORT

STATISTICAL RESEARCH CENTER
Tel. (301) 209-3070

E-mail: stats@aip.org
www.aip.orgistatistics

by Raymond Y. Chu

November 2004

Salaries for PhD Physicists and Related Scientists during Spring 2004: Summary Report

This is a summary of the latest salary data for physicists and related scientists. It is based on a biennial survey of a sample of U.S.-resident members of the American Institute of Physics (AIP) Member Societies conducted by the Statistical Research Center of AIP. For the past 24 years, this report series has documented the salary, employment and demographic characteristics of the U.S. members of the AIP's ten Member Societies. This year, the trends include:

The median annual salary for respondents with PhDs rose to $90,000 in 2004 from $87,000 in 2002.

The highest median salaries were reported by society members with PhDs employed in hospitals or medical services, at $120,000. The median salary for those working in 4-year colleges with 9-10 month contracts has remained stagnant at $56,000.

The highest typical salaries ($77,000 to $124,000) are found in the Pacific states. The lowest are in the West North Central states ($55,000 to $100,000). Most society members reside and work on the East and West coasts. These regions also tend to have the most competitive salaries.

Ph.D.'s working in industry and who are society members reported a median salary of $104,000 in 2004, up from $100,000 in the 2002 survey. The percentage growth in salaries for industrial Ph.D.'s was slightly above the 3.3% inflation rate measured by the Consumer Price Index for All Urban Consumers (CPI-U) during the period between the two surveys. Although the increase in median salary outpaced the inflation rate, the momentum of growth dropped off.

Typical salaries and median age for major employment sectors, PhDs 2004. (a)

Academic sector	Typical salaries (in thousands)	Median Age
University		
9-10 month salary	$60 to 96	48
11-12 month salary	$59 to 110	48
4-Year college		
9-10 month salary	$49 to 68	46
Non-Academic sector		
Hospital, medical services	**$92 to 150**	**48**
FFR&DC (b)	**$96 to 130**	49
Industry, self-employed	$85 to 127	47
Government	$86 to 125	51
Nonprofit	$67 to 108	47
UARI (b)	$60 to 100	46

(a) Employed U.S. resident members only. Postdoctorates excluded.
(b) FFR&DC=Federally-Funded Research and Development Center
UARI=University-Affiliated Research Institute or Observatory

Members with postdoctorate appointments at universities who earned their PhDs within the past two years reported typical salaries of $35,000 to $42,000.

The unemployment rate (1.7%) among society members with PhDs has risen slightly since 2000. However

Typical salaries for selected university ranks, PhDs, 2002. (a)

Academic rank	Typical salaries (in thousands)
Professor	
9-10 month salary	$78 to 112
11-12 month salary	**$100 to 150**
Associate professor	
9-10 month salary	$58 to 78
11-12 month salary	$71 to 100
Assistant professor	
9-10 month salary	**$48 to 62**
11-12 month salary	$50 to 70
Research faculty (11 to 12 mos)	
Postdocs 0-2 years since PhD	$35 to 42
Postdocs 3-4 years since PhD	$36 to 45
Other research faculty	$50 to 76

(a) Employed U.S. resident members only.

Methodology

The AIP Membership Sample Survey is the largest survey conducted by AIP's Statistical Research Center (SRC). More than 21,600 individuals, approximately one-fourth of the U.S. members of AIP's Member Societies were selected on the basis of a stratified random sample and asked to report their salary and employment data as of March 2004. Nearly 12,300 responded after three e-mail requests for an overall response rate of 57%.

The data represent responses from members of the American Physical Society, Optical Society of America, Acoustical Society of America, The Society of Rheology, American Association of Physics Teachers, American Crystallographic Association, American Astronomical Society, American Association of Physicists in Medicine, AVS The Science and Technology Society, and American Geophysical Union. Within the research portion of its mission, the SRC collects, analyzes, and disseminates data on education and employment in physics and related fields.

Detailed salary data from this survey are currently available for purchase on the AIP Store on the web. The salary data are presented in twelve tables that each focus on different aspects of PhD salaries and can be found on the AIP Store.

American Institute of Physics
www.aip.org/statistics/trends/reports/salary04.pdf

PHYSICS TRENDS

Contact: Raymond Y. Chu
rchu@aip.org

Winter 2003

Faculty Salaries, 2002

	Typical Range (in thousands of dollars)
UNIVERSITY *12 month salary*	
Full Professor	**97 — 147**
Associate Professor	**70 — 92**
Assistant Professor	**56 — 75**
UNIVERSITY *9 month salary*	
Full Professor	**75 — 109**
Associate Professor	**55 — 75**
Assistant Professor	**48 — 63**
FOUR-YEAR COLLEGE *9 month salary*	
Full Professor	**59 — 88**
Associate Professor	**47 — 63**
Assistant Professor	**42 — 51**

Source: 2002 Salaries - Society Membership Survey

Statistical Research Center
American Institute of Physics
www.aip.org/statistics

C. Bibliography of Scholarly Activity

SCHOLARLY ACTIVITY

FY 2004 Refereed Publications and Presentations:

"Modeling sub-50 fs Laser Propagation." G. D. Buffington, M. Edwards, R. J. Thomas, 11th Air Force Office of Scientific Research Laser Bioeffects Collaborative Workshop, Air Force Research Laboratory, Brooks City-Base, TX. 3-4 March 2004.

"Generalized Thermal Modeling," R. J. Thomas, M. Edwards, G. D. Buffington, 11th Air Force Office of Scientific Research Laser Bioeffects Collaborative Workshop, Air Force Research Laboratory, Brooks City-Base, TX. 3-4 March 2004.

"LIB Thresholds at 44 fs, 810 nm for Chirped and Non-Chirped Laser Pulses," G. D. Buffington, C. P. Cain, R. J. Thomas, D. J. Stolarski, G. D. Noojin, P. K. Kennedy, and B. A. Rockwell, KSU Department of Physics Atomic, Molecular, Optical Colloquium, Manhattan, KS. 28 April 2004.

"Bond Breaking and Temporary Anion States in Uracil and Halouracils: Implications for the DNA Bases," A. M. Scheer, K. Aflatooni, G. A. Gallup, and P. D. Burrow, Physical Review Letters, 92, No. 6 (2004).

FY 2004 Non-refereed Publications and Presentations:

"Multiple Wavelength Exposures to the Retina," B. A. Rockwell, C. P. Cain, K. Schuster, R. J. Thomas, M. Edwards, and G. D. Buffington, 25th Lasers on the Modern Battlefield Conference, Air Force Research Laboratory, Brooks City-Base, TX. 23-27 February 2004.

"USAF Research Laboratory Laser Safety Modeling and Simulation," R. J. Thomas, P. K. Kennedy, M. Edwards, K. Keppler, D. Huantes, R. Pingry, G. D. Polhamus, R. Gallaway, and G. D. Buffington, 25th Lasers on the Modern Battlefield Conference, Air Force Research Laboratory, Brooks City-Base, TX. 23-27 February 2004.

"Retinal Injury from Simultaneous Exposure to 532nm and 860nm Laser Irradiation," B. A. Rockwell, C. P. Cain, K. Schuster, R. J. Thomas, M. Edwards, and G. D. Buffington, Photonics West (BiOS) 2004 Conference, San Jose, CA. 24-29 January 2004.

"A Complete Determination of Photoelectron Partial Wave Probabilities by Polarization Analysis of the Fluorescence from an Excited Xe Photoion" poster presentation, K. W. McLaughlin, O. Yenen, D. H. Jaecks, T. J. Gay, and K. Aflatooni, Division of Atomic, Molecular and Optical Physics (DAMOP) Meeting of American Physical Society, Tucson, AZ. May 2004.

"Experimental Identification of Fano Effect in Ar Satellite," poster presentation, O. Yenen, D. H. Jaecks, T. J. Gay, J. R. Machacek, K. W. McLaughlin, and K. Aflatooni, Division of Atomic, Molecular and Optical Physics (DAMOP) Meeting of American Physical Society, Tucson, AZ. May 2004.

FY 2005 Refereed Publications and Presentations:

"Sub-50 fx Laser Retinal Damage Thresholds in Primate Eyes with Group Velocity Dispersion, Self-Focusing and Low-Density Plasmas," Clarence P. Cain, Robert J. Thomas, Gary D. Noojin, David J. Stolarski, Paul K. Kennedy, Gavin D. Buffington, and Benjamin A. Rockwell, Grafe's Arch. Clin. Exp. Opthalomol. 234:101-112 (2005).

"How is Energy Like Money? Using Analogies in Physics Teaching," W. Gonzalez-Espada and K. Trantham, School Science Review. June 2005.

"Construction and Tuning of a Polarized Electron Source," K. Trantham, UNL Department of Physics. May 2005.

"Eliciting and Representing Hybrid Mental Models," Z. Hrepic, D. Zollman, & S. Robello, Annual Meeting of the National Association for Research in Science Teaching, Dallas, TX. 4-7 April 2005.

FY 2005 Non-refereed Publications and Presentations:

"Extension of Thermal Damage Models of the Retina to Multi-Wavelength Sources," Robert J. Thomas, Clarence P. Cain, Gary D. Noojin, David J. Stolarski, Gavin D. Buffington, Lance J. Irvin, Michael L. Edwards, Benjamin A. Rockwell, Proceedings of the 2005 International Laser Safety Conference, Marina del Rey, CA. March 2005.

"Predicted Trends in Retinal Damage Thresholds for Pulse Durations Shorter than 50fs and Implications to Maximum Permissible Exposure Levels," Benjamin Rockwell, Gavin D. Buffington, Michael L. Edwards, J. Steven Rosenboom, Robert J. Thomas, Proceedings of the 2005 International Laser Safety Conference, Marina del Rey, CA. March 2005.

"A First-Order Model of Thermal Lensing of Laser Propagation in the Eyes and Implications for Laser Safety," Robert J. Thomas, Rebecca L. Vincelette, Gavin D. Buffington, Amber D. Strunk, Michael L. Edwards, Benjamin A. Rockwell, Ashley J. Welch, Proceedings of the 2005 International Laser Safety Conference, Marina del Rey, CA. March 2005.

"Coupling of Thermal Damage Models of the Retina to Atmospheric Scintillation Models for CW Laser Exposures," Robert J. Thomas, Steven C. Rose, Tim T. Clark, Gavin D. Buffington, Michael L. Edwards, Benjamin A. Rockwell, Proceedings of the 2005 International Laser Safety Conference, Marina del Rey, CA. March 2005.

"Cold Plasmas and Optical Lattices," K. Trantham, Session Chair, Meeting of the American Physical Society, Division of Atomic, Molecular and Optical Physics (DAMOP), Lincoln, NB. May 2005.

"Eliciting and Representing Hybrid Mental Models," Z. Hrepic, Dean A. Zollman, and N. Sanjay Rebello, 129th American Association of Physics Teachers (AAPT) National Meeting, Sacramento, CA. August 2004.

"Eliciting and Representing Hybrid Mental Models," Z. Hrepic, Dean A. Zollman, and N. Sanjay Rebello, Annual Meeting of the Arkansas-Oklahoma-Kansas AAPT Section, Little Rock, AR. October 2004.

"Developing an Inquiry-Based Physical Science Course for Preservice Elementary Teachers," Zdeslav Hrepic, Paul Adams, Nancy Talbott, Germaine Taggart, Lanee Young, Annual Meeting of the Arkansas-Oklahoma-Kansas AAPT Section, Little Rock, AR. October 2004.

FY 2005 Grant Proposals

External Grant Applications:
Proposal for HP Instructional Technology grant, (PI, $70,500). Title: Investigating Impact of Classroom Usage of Wireless Tablet PCs on Student's Learning.

Funded External Grants:
Proposal for Kansas Board of Regents (KBOR), (CoPI, Paul Adams, PI, $706,667). Title: Physical Science with Mathematical Modeling Workshop.

FY 2006 Refereed Publications and Presentations:

"Simultaneous Exposure Using 532 and 860 nm Lasers for Visible Lesion Thresholds in the Rhesus Retina," William Roach, Robert Thomas, Gavin Buffington, Garrett Polhamus, John Notabartolo, Cheryl DiCarlo, Kevin Stockton, David Stolarski, Kurt Schuster, Val Carothers, Benjamin Rockwell, Clarence Cain, Health Phys. 90(3):241-249 (2006).

"Developing an Inquiry-Based Physical Science Course for Preservice Elementary Teachers," Zdeslav Hrepic, Paul Adams, Jason Zeller, Nancy Talbott, Germaine Taggart, Lanee Young, paper presented at the 2005 Physics Education Research Conference, Salt Lake City, Utah, published in conference proceedings.

"S.F. Dynamic Transfer: A Perspective from Physics Education Research," N. S. Rebello, D. A. Zollman, A. R. Allbaugh, P. V. Engelhardt, K. E. Gray, Z. Hrepic, S. F. Itza-Ortiz, in J. P. Mestre (Ed.), Transfer of Learning: Research and Perspectives, Greenwich, CT: Information Age Publishing.

"Building and Activating a GaAs Spin Polarized Electron Source," University of Nebraska at Lincoln. July 2005.

FY 2006 Non-refereed Publications and Presentations:

"Resonances and Bond-breaking in Bio-molecules", Kayvan Aflatooni, invited talk at FHSU Sigma Xi Chapter, 2 March 2006.

"Model of Thermal Lensing of the Closed Aperture Z-Scan Method for the Propogation of Laser Light in Ocular Media," R. L. Vincelette, R. J. Thomas, G. D. Buffington, L. J. Irvin, M. L. Edwards, B. A. Rockwell, A. J. Welch, Optical Interactions with Tissue and Cells XVII, Proceedings of SPIE (2006).

"Developing an Inquiry-Based Physical Science Course for Preservice Elementary Teachers," Zdeslav Hrepic, Paul Adams, Jason Zeller, Nancy Talbott, Germaine Taggart, Lanee Young, Second Annual National Conference on the Preparation of Physics and Physical Science Teachers, Fayetteville, AR. March 2006.

"Developing an Inquiry-Based Physical Science Course for Preservice Elementary Teachers," Zdeslav Hrepic, Paul Adams, Jason Zeller, Nancy Talbott, Germaine Taggart, Lanee Young, 129th American Association of Physics Teachers (AAPT) National Meeting, Salt Lake City, UT. August 2005.

"Integrating Mathematics and Physical Science in an Inquiry Approach," Paul Adams, Zdeslav Hrepic, Lanee Young, School Science and Mathematics (SSMA) 2005 Annual Convention, Fort Worth, TX. November 2005.

FY 2006 Grant Proposals

External Grant Proposal: HP Instructional Grant (PI, Zdeslav Hrepic, $70,500). Title: Improving Students' Problem Solving Skills Using Wireless Tablet PCs.

C. Program Assessment Results

NORMED RESULTS

ETS Major Field Test in Physics											
Years	**Number of Examinees**		**National Median**			**FHSU Median**					
	National	**FHSU**	**Total Test**	**Lower Division**	**Upper Division**	**Total Test**	**% of National below FHSU**	**Lower Division**	**% Above National**	**Upper Division**	**% Above National**
1999-2002	989		145.5	45.2	44.5						
1993-1996	806		145.3	*	*						
1996-2005		38				147.5	55.3				
1999-2005		33						48.0	54.5	47.0	57.6
2005		5				147.0	60.0	47.0	60.0	46.0	60.0
2006		2	145.0			153.0	67.5	NA	NA	NA	NA

* Sub-tests for lower and upper division physics did not exist until 1999

SENIOR DATA

ETS Major Field Test in Physics for Seniors						
Year	**Student**	**Class**	**Score**	**GPA**	**Subscore 1**	**Subscore 2**
1996	Michael Seltmann	Senior	154	3.35		
1996	Paul Scheuerman	Senior	145	3.44		
1996	Jody Lichter	Senior	129	3.65		
1998	Craig Hartman	Senior	151	3.37		
1998	Tyrone Martin	Senior	149	2.98		
1999	Kurt Schuster	Senior	141	2.45	34	51
1999	Jim Pearce	Senior	138	2.85	40	37
2000	Stephen Black	Senior	164	3.95	56	70
2000	Jared Hund	Senior	149	3.17	45	53
2000	Andy Prideaux	Senior	149	2.96	51	47
2000	Peter Briley	Senior	141	2.22	36	47
2000	E. Matt Lay	Senior	130	2.78	22	40
2001	Stephen Black	Senior	163	3.95	65	57
2001	Glenn Gronniger	Senior	141	3.16	48	34
2001	Alex Vieux	Senior	134	2.38	34	37
2002	Kate Denning	Senior	164	3.94	59	66
2002	Miles Stearns	Senior	161	3.76	56	63
2002	Justin Zohner	Senior	154	3.51	59	47
2002	Brian House	Senior	148	2.16	48	47
2002	Brett Neumann	Senior	146	3.37	48	44
2002	Lucas Chavey	Senior	143	3.21	45	40
2002	Glenn Gronniger	Senior	125	3.19	34	20
2002	Duane Schoenberger	Senior	125	3.02	20	34
2003	Jack Maseberg	Senior	154	3.48	53	53
2003	Adam Caprez	Senior	153	3.55	53	50
2003	Jonathan Rosenboom	Senior	151	3.24	51	50
2003	Kayle Devaughan	Senior	148	3.59	51	44
2003	Bret Rogers	Senior	141	2.84	45	37
2003	Kevin Booze	Senior	136	2.68	42	31
2003	Shannon Madison	Senior	128	3.56	25	34
2004	Logan Frank	Senior	159	3.62	53	63
2004	Clifton Clark	Senior	156	3.32	59	50
2004	Wesley Henderson	Senior	143	3.02	39	47
2005	Tara White	Senior	165	3.94	60	67
2005	Logan Frank	Senior	160	3.66	55	64
2005	Douglas Goddard	Senior	147	2.41	47	46
2005	Amber Strunk	Senior	130	3.14	26	37
2005	Thoman George	Senior	123	2.45	26	22
2006	Paul Maseberg	Senior	174	3.97	NA	NA
2006	Jessica LeCount	Senior	132	3.62	NA	NA
	Mean All Senior		146.1	3.22	45.0	46.3
	Mean 2006		153.0	3.80	42.8	47.2
	Median All Sr.		147.5	3.23	48.0	47.0
	Median 2006		153.0	3.80	47.0	46.0

INSTITUTIONS ADMINISTERING THE MAJOR FIELD TESTS
(Institutions with five or more senior examinees in the time period specified)

PHYSICS II (8/1999-6/2002)

Andrews Univ., MI
Augusta State Univ., GA
Ball State Univ., IN
Benedict College, SC
Benedictine College, KS
Benedictine Univ., IL
Berry College, GA
Boise State Univ., ID
Bridgewater College, VA
Butler Univ., IN
Cameron Univ., OK
Central Washington Univ., WA
Centre College, KY
Clark Atlanta Univ., GA
California State Univ.-Fresno, CA
Eastern Illinois Univ., IL
Eastern Kentucky Univ., KY
Eckerd College, FL
Erskine College, SC
Fisk Univ., TN
Fort Hays State Univ., KS
Francis Marion Univ., SC
Frostburg State Univ., MD
Furman Univ., SC
Grove City College, PA
Hillsdale College, MI
James Madison Univ., VA
Juniata College, PA
Kalamazoo College, MI
Kent State Univ., OH
Kenyon College, OH
King College, TN
Lincoln Univ., PA
Longwood College, VA
Mesa State College, CO
Miami Univ., OH
Michigan Tech. Univ., MI
Millersville Univ., PA
Millsaps College, MS
Morehead State Univ., KY
Muskingum College, OH
North Georgia College & State Univ., GA
Northwest Nazarene Univ., ID
Northwestern State Univ., LA
Oklahoma Baptist Univ., OK
Old Dominion Univ., VA
Pacific Union College, CA
Southeast Missouri State Univ., MO
Southwest Missouri State Univ., MO
Spelman College, GA
Taylor Univ., IN
Tennessee Tech. Univ., TN
Towson Univ., MD
Truman State Univ., MO
U. S. Air Force Academy, CO
Univ. of Central Florida, FL
Univ. of Central Arkansas, AR
Univ. of Massachusetts-Lowell, MA
Univ. of Mississippi, MS
Univ. of Missouri-Columbia, MO
Univ. of Missouri-Rolla, MO
Univ. of Missouri-St. Louis, MO
Univ. of Northern Colorado, CO
Univ. of Southern Colorado, CO
Univ. of Oklahoma, OK
Univ. of Richmond, VA
Univ. of Saint Thomas, MN
Univ. of Wisconsin-Eau Claire, WI
Univ. of Wisconsin-Stevens Pt., WI
Univ. of Wisconsin-Whitewater, WI
Virginia Military Institute, VA
West Virginia Wesleyan College, WV
Western Michigan Univ., MI
Yeshiva Univ., NY

E. Other Departmental Information

Degree Data for FHSU Peers and Kansas Regent's Universities

The Statistical Research Center of the American Institute of Physics publishes an annual survey of enrollments and degrees each year. The August 2005 report was for AY 2004 data.

University (Undergraduate Enrollments*)	2002	2003	2004	Average
Eastern Washington University (7,567)	2	5	5	4.0
Northern Michigan University (7,575)	4	2	2	2.7
Northwest Missouri State University (5,568)	1	1	3	1.7
Salisbury State University (5,883)	8	12	9	9.7
Western Carolina University	NR	NR	NR	NR
Emporia State University (4,198)	NR	2	3	2.5
Pittsburg State University (5,222)	1	3	3	2.3
Kansas State University (18,252)	5	3	4	4.7
The University of Kansas (19,698)	6	6	2	6.0
Wichita State University (11,377)	3	2	0	1.7
Washburn University (4,888)	2	2	6	3.3
FHSU (4,418)	10	8	4	7.3

*From www.uscollegesearch.org

Fort Hays State University

Department of Physics

Mission

We produce graduates with the knowledge, skills, and attributes that will enable them to enter and be successful in graduate school or the workforce.

Vision

We are the best undergraduate physics department in Kansas.

Core Values

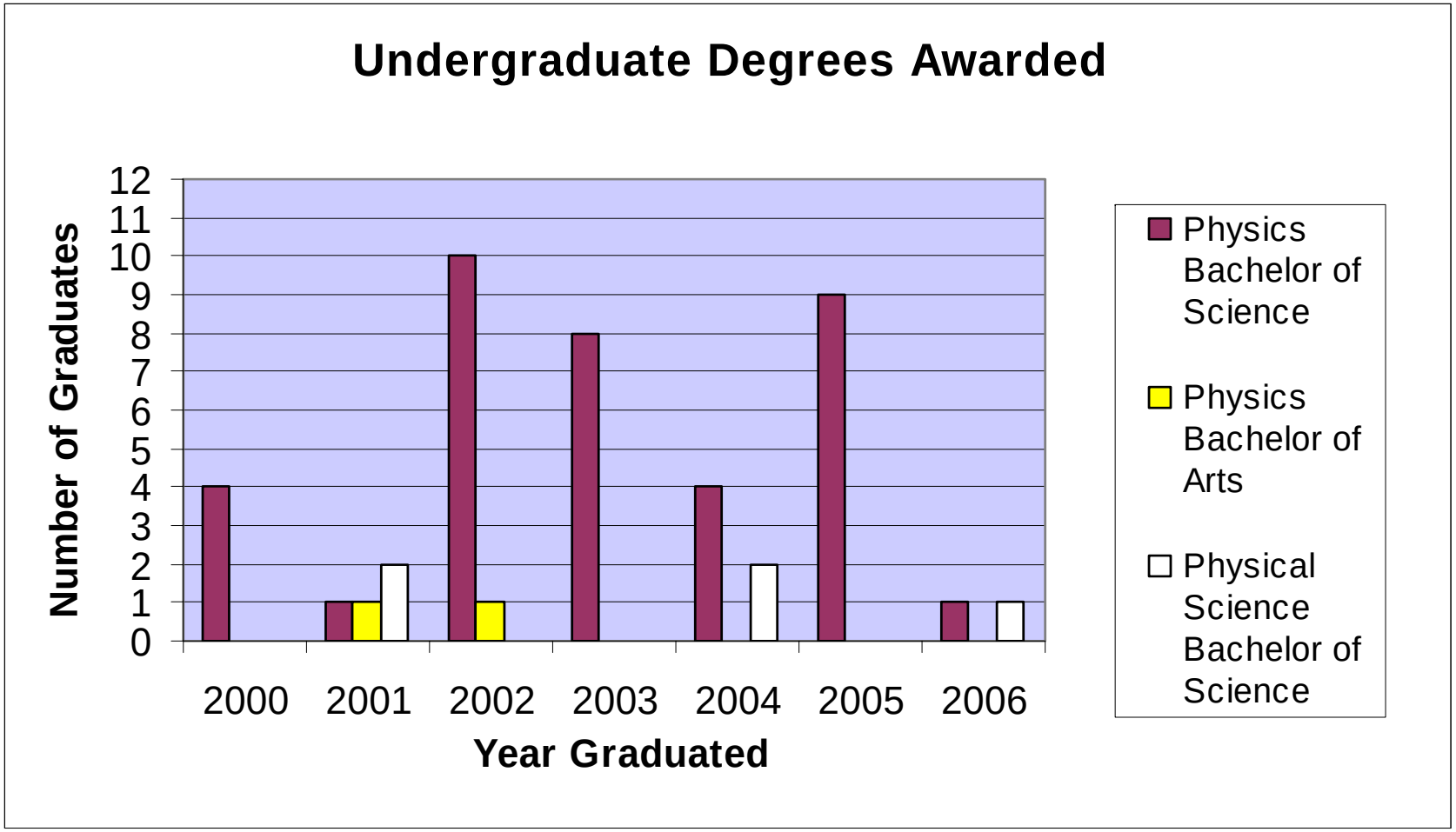
Graduates of the department of physics are known for:

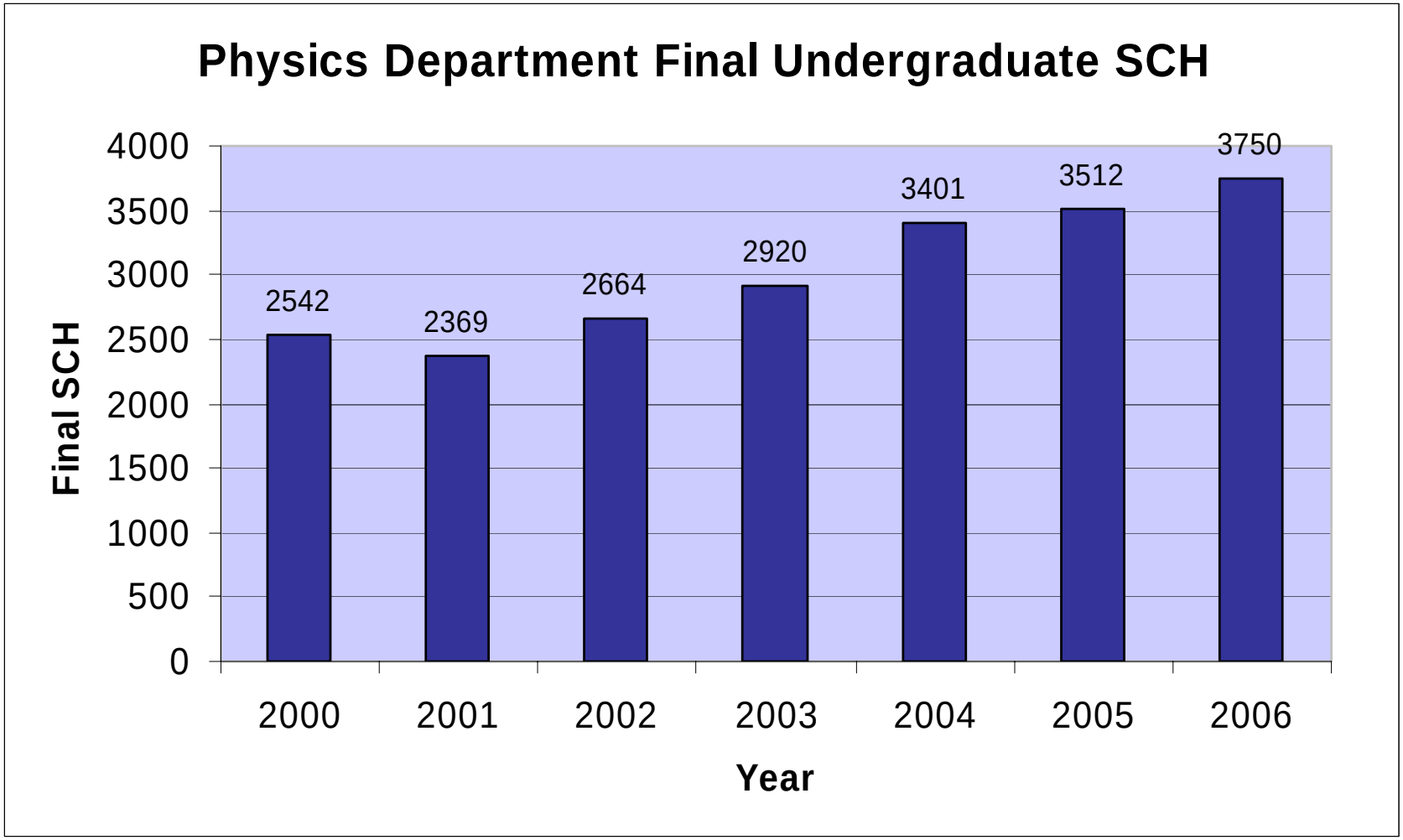
- Honesty and professional integrity
- Analytical thinking skills
- Critical thinking skills
- Problem solving skills
- Oral and written presentation skills
- Ability to work independently
- Ability to work as members of a team
- Ability to learn and adapt throughout their professional careers

Strategic Priorities

The department of physics is known for:

- Faculty for whom teaching and student success are top priorities. Preparing students for successful entry into the workforce in industry, business, government laboratories and teaching.
- Preparing students for successful entry into graduate school in physics, engineering and business.
- Research programs suitable for undergraduate student participation.
- High quality physics courses required for other majors.
- High quality general education courses that imbue enthusiasm for science in the general student population.
- High quality virtual college courses for off-campus students.
- Public service activities for schools, government, business and industry, the community and the discipline of physics.


Undergraduate Degrees Awarded
Number of Graduates
0
1
2
3
4
5
6
7
8
9
10
11
12
2000
2001
2002
2003
2004
2005
2006
Year Graduated
Physics Bachelor of Science
Physics Bachelor of Arts
Physical Science Bachelor of Science


Physics Department Final Undergraduate SCH
Final SCH
4000
3500
3000
2500
2000
1500
1000
500
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2542
2369
2664
2920
3401
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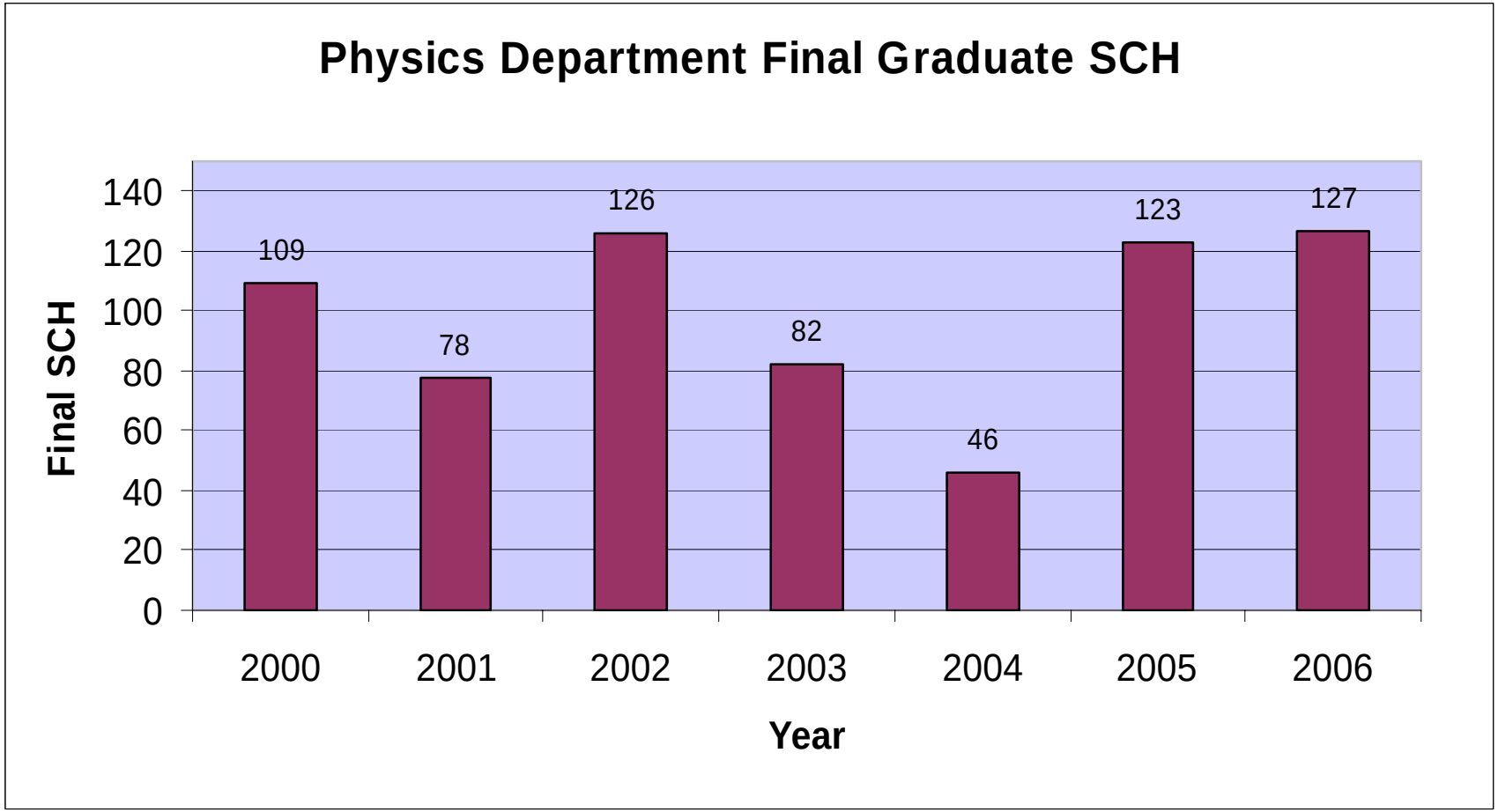
2000
2001
2002
2003
2004
2005
2006
Year


Physics Department Final Graduate SCH
Final SCH
140
120
100
80
60
40
20
0
109
78
126
82
46
123
127
2000
2001
2002
2003
2004
2005
2006
Year